DOCUMENT RESUME

ED 444 468 IR 020 123

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TITLE	Effective Curricular Software Selection for K-12 Educators.
PUB DATE	2000-00-00
NOTE	7p.; In: Society for Information Technology & Teacher Education International Conference: Proceedings of SITE 2000 (11th, San Diego, California, February 8-12, 2000). Volumes 1-3; see IR 020 112.
PUB TYPE	Guides - Non-Classroom (055) -- Speeches/Meeting Papers (150)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	*Computer Software Evaluation; *Computer Software Selection; *Courseware; Elementary Secondary Education; Evaluation Methods; Internet; Models; Needs Assessment; Vendors
IDENTIFIERS	Web Sites

ABSTRACT

Increases in the availability of technology, the range of content software, and curriculum via the Internet have placed countless options in the hands of teachers. Similarly, increasing accountability has placed added pressure on teachers to meet stated objectives and ensure student performance. How can teachers optimize available technologies and related content to support classroom efforts? Effective decisions are based on a clear understanding of the challenge or challenges to be addressed, selection of software based on the identified challenge, dedicated classroom usage, and evaluation and implementation modification as required. The 4DIEM Model supports teachers as they engage in selection of technology-based content. This paper identifies five categories of software and Internet-based experiences, i.e., tutorial, drill and practice, simulation, productivity (tools), and informational (tools). The following components of the 4DIEM Model are then detailed: (1) describe the objective; (2) determine the type of software; (3) decide on several appropriate software titles; (3) test drive the software; (5) integrate the software into lesson plans; (6) evaluate its effectiveness regularly; and (7) modify use as needed. Top K-12 reading/language arts and mathematics software providers, as well as top K-12 Internet sites, are listed. (MES)

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Effective Curricular Software Selection for K–12 Educators

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Increases in the availability of technology, the range of content software, and curriculum via the Internet have placed countless options in the hands of teachers. Similarly, increasing accountability has placed added pressure on teachers to meet stated objectives and ensure student performance. How can teachers optimize available technologies and related content to support classroom efforts? Effective decisions are based on clear understanding of the challenge or challenges to be addressed, selection of software based on the identified challenge, dedicated classroom usage, and evaluation and implementation modification as required. The 4DIEM Model supports teachers as they engage in selection of technology-based content.

The last five years have increased the amount of technology available to classroom teachers. Personal computers, networked classrooms, and the Internet–in addition to televisions, VCR's, Videodisc players, video cameras, digital cameras–all provide opportunities to extend classroom resources and present informational and educational materials to students. Between 50-89% of school library media centers in the United States have Internet access; 30-79% have access via computer labs.

With hardware and an access infrastructure increasingly in place, attention moves from the technology itself to the content provided via the technology. Educators are faced with finding technology-based content that:

- is correlated to district and state standards;
- makes full use of the features and advantages of technology;
- is easily integrated into the classroom;
- provides meaningful feedback;
- and is pedagogically sound, rich, and motivational.

Our experience working with three different software vendors and schools in each of the 50 United States has provided valuable insight as we seek to provide at least a partial solution to these technology-based problems. While attention has been given to specific guidelines for *review* of a specific software program, less attention has been dedicated to the larger issue of *matching educational software to specific needs*. Our intent is to encourage simple planning and assessment, followed by evaluation, to increase the effectiveness of any type of software technology purchased and implemented in the classroom. By pre-defining needs and selecting technology interventions matched to those needs, educators can optimize their available resources and the content provided to their students.

According to Dale Mann of Teachers College, Columbia University, "The school is the last unreformed institution from the 18th century that we are about to trundle, unreformed, into the 21st. Agriculture, medicine, commerce, transportation, and communications have all transformed" (Mann, 1999). We encourage you to play a part in the transformation of education.

Content Software and Internet Resources

Diverse pedagogical approaches provide the underpinnings of most effective educational software and Internet activities. Software and Internet-based experiences can be routinely placed into one or more of the following categories with which educators should be familiar as they evaluate content options.

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Tutorial
Tutorials present a new concept. They often employ text, illustrations, description, or simulations to teach a specific task, skill, or application. Most productivity software packages include a tutorial to teach the user how to use the application. Many educational software programs provide step-by-step instructions describing how to perform an objective and include examples of problems and solutions.

Drill and Practice
Drill and Practice software targets the reinforcement of skills, most often by shaping user behaviors. Mavis Beacon Typing Tutor and Math Blaster are examples of this type of software.

Simulation
Simulations put the user in the middle of the action, often creating an environment which the user manipulates with varied results. Problem solving is key to most simulations, and activities typically reinforce the discovery process through primarily constructivist learning environments. Oregon Trail and SIM City are examples of an educational simulation.

Productivity (Tools)
This type of software supports the user in accomplishing specific tasks. It seeks to relieve the user of routine tasks, allowing concentration on the content being developed. Word processors, spreadsheets, and databases are all examples of productivity tools.

Informational (Tools)
Information software is just that, information rather than instruction. It provides data for the user to access and examine. Microsoft's Encarta CD-ROM encyclopedia and Dictionary.com (www.dictionary.com) are examples of informational software.

Software Needs Assessment

Regardless of the type of software, the chance effective learning will occur is at risk when the content and approach does not match the specific need of the learner. For example, providing students with drill and practice software on the multiplication tables will likely provide benefit. However, if multiplication tables are not currently the focus of classroom instruction, and therefore not supported and reinforced through other experiences, learning is not optimized. This can be likened to what we refer to as the Sesame Street effect: children may indeed learn basic skills from Sesame Street, but the impact is greatly increased when parents reinforce the skills presented in the television program, and further still when what is presented in the program and reinforced by the parent is a current classroom topic.

Understanding the specific need, or learning objective(s), to be addressed is critical to making effective decisions regarding content and technology. In fact, a clear understanding of the need may prove that technology is *not* the best approach or medium for meeting the need. Predicated on this assumption, Table 1 details a process which emphasizes front-end assessment and follow-up evaluation.

We call this the 4DIEM method of software selection and use, with each letter of the acronym supporting a specific step in the process. The overall intent is to first identify and then remain focused on the specific objective(s) you seek to target with the software. The following pages provide further detail for each component of the 4DIEM model.

The 4DIEM Model

DESCRIBE the objective
It is critical to have a clearly defined set of finite instructional objectives before you begin a software search. Many software vendors promise to boost basic skills or enhance critical thinking, but beware of these generalized promises: You have to be able to evaluate the success of the software in your classroom, which means that you have to know what you want it to accomplish. Make a list of the specific objectives that you want to target and keep it close by throughout this process. Ask yourself if the identified objectives are appropriate for your students and whether or not attainment of the objectives can be measured.

DETERMINE the type of software
After identifying the learning objectives that you will target, you must determine if appropriate software exists. Additionally, from a budgetary position, you will want to consider what software your school already owns.

If technology-based instruction is appropriate for the identified objective, consider what type of software would best meet the identified objective(s) and the needs of your students. Do you need it to teach the steps of a rule? Do you need it to provide lots of practice? Is it teaching a real-world skill that needs simulated application? Is the software you need a tutorial, a drill and practice, a simulation? Or should it provide content knowledge or be a productivity tool?

Think about how you will use integrate the software into your classroom. You will want to ensure students receive instruction to develop their initial understanding of a particular skill. Some drill software just helps children become fluent at a skill; in these cases, teachers should use another method to help students learn the underlying concept.

DECIDE on several appropriate software titles
Here is where you will likely be influenced by the budget available. You may be looking for a CD-ROM or two for use with your class or you may be involved in a district-wide technology adoption. It really makes little difference; if you have clearly defined your need, you will be able to review the appropriate software and determine if there is a match.

If you have a small allocation, you will most likely turn to over-the-counter software. Go to catalogs of respected providers. If you are involved in a significant technology adoption, you'll likely be reviewing and considering comprehensive curriculum software products. For example, the integrated learning systems provided by Jostens Learning, Lightspan, CCC, Davidson, or Kaplan.

Tables 2, 3, and 4 detail some educator-reviewed resources that include both over-the-counter and Internet content. Additionally, there are many excellent software review services: see SuperKids Educational Software Review (http://www.superkids.com/aweb/pages/reviews/alpha2.shtml) and the Children's Software Revue (http://www.childrenssoftware.com/). In addition, the Children's Software Review links page (http://www.childrenssoftware.com/links.html) provides many other resources where reviews are shared and software is discussed.

TEST DRIVE the software
If you are in the market for a new car and you heard in an advertisement that the new Ford Focus made driving 100% safer, would you walk into a dealership and purchase the car sight unseen? Unfortunately, educators have been known to spend ten-times the amount of that car on technology-based curriculum without allowing the driver and passengers (read: teacher and students) to take it for a test drive.

Most important, next to identification of your targeted objective(s), is reviewing the software and ensuring it will meet your needs. Many software programs are purchased only to collect dust due to the omission of this step. Routinely question the marketing claims made by the vendors–after all, they are trying to sell the software. Personally review the program to see if it is easy-to-use and matches your identified objectives. Ask for evidence of effectiveness in classrooms similar to your own. Then, select a few students and have them work through the program. Solicit their experiences; have them reflect on what they learned.

Note that many software review checklists and guidelines have been published over the years. Use these resources to ensure adequate and comprehensive review. For a rich resource of evaluation guidelines, checklists, and heuristics, see http://school.discovery.com/schrockguide/eval.html.

INTEGRATE the software into lesson plans
In a survey done by Global Strategy Group, Inc. only 37% of polled educators consistently integrate instructional software into their curriculum. Do not assume simply because you have targeted objectives that the software will immediately integrate into your classroom curriculum. Technology is a relative newcomer to the classroom and must be introduced, welcomed, observed, respected, and called-on to become an integral member of the class. Textbooks have a century of historical precedent on their place in the classroom—technology needs some hand holding as we figure out how best to integrate it. EdWeek

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recommends that teachers *"[m]ake sure the technology has features and functions that fit your curriculum. If a software publisher hasn't worked out how to integrate its product with the subject, you must do it–or cast it aside" (Trotter, 1998).*

EVALUATE its effectiveness regularly
Our experience has shown that once a software program is selected—be it an over-the-counter drill and practice math program or a school-wide integrated learning system—scant resources are dedicated to evaluating the effectiveness of the program. We encourage you to question your decisions and seek opportunities to prove effectiveness. This certainly does not need to be a full-scale evaluation; make use of existing assessment materials or develop specific tools. Quick checks, quizzes, and tests can be used to evaluate tutorials, informational products, and drill and practice software; consider portfolio projects and other authentic assessments to evaluate simulations and productivity tools. It should be noted that many teachers have found clever ways to use the technology itself to evaluate student learning. Regardless of the approach, seek to understand the effect technology is having on student learning in your classroom and identify ways you can continuously improve your practices.

MODIFY use as needed
Based upon the results of your evaluation, repeatedly modify your classroom use to meet the changing needs of individual students and classes. Continue to use evaluation to diagnose and assess student needs and match appropriate technology-based content.

Summary

When selecting technology-delivered content, educators must identify specific goals and objectives which the software will support. Rather than having learning be incidental, we encourage teachers to target specific learning objectives and seek out software to meet those objectives. Follow selection with effective classroom usage, evaluation, and modification of your implementation plan. Using the 4DIEM model to guide this process will help ensure attention to front-end assessment, thus enhancing the effectiveness of your technology-based content.

References

Mann, D. (1999). Educational reform and the role of instruction: From schools to education and from teaching to learning. Paper prepared for the World Congress on International Education, Integration and Development, Buenos Aires, Argentina, July 28-30, 1999.

Trotter, A. (1998). Technology counts '98: Putting school technology to the test. Bethesda, MD: Education Week on the Web. Retrieved November 30, 1999 from the World Wide Web: http://www.edweek.com/sreports/tc98/

Activity	Description	Considerations
DESCRIBE...	the need you wish to address, and the outcome you expect	What is it that your students need to know? Why is it not already happening in your classroom?
DETERMINE ...	a) if software is available to meet your need; b) and, if so, the type of software you need: tutorial, drill and practice, simulation, informational, productivity	What type of pedagogical approach makes sense with the given objective? Consider your students and their abilities–including their technology literacy.
DECIDE...	on several appropriate software titles	What software is already available at your school? Through the district office? If funds are available, review print and online commercial and educational software catalogs.
TEST DRIVE...	the software yourself *and* with several students before you buy it	Does the software directly support the need you identified at the outset? Is this a program that can be effectively used in the classroom? From the student perspective: Can students operate the program? Do they enjoy using it? Are they learning from it?
INTEGRATE	into lesson plan in phases.	Bring the program into you lesson plan based on student needs: as individual enrichment/remediation, as a small group presentation/activity, and as a large group presentation/activity
EVALUATE ...	its effectiveness regularly	Monitor student progress and learning formally and informally. Ask students questions about what they learned from the software program. Use existing assessments to understand the contribution made by the software to student learning.
MODIFY...	classroom use as needed	Use the results of your evaluation to optimize your implementation and classroom use.

Table 1: 4DIEM Model

Vendor	Title
The Learning Company	Children's Writing & Publishing Center (one of the top overall titles), Student Writing Center, Reader Rabbit (the top overall title), Super Solvers: Midnight Rescue!
Claris	ClarisWorks (one of the top overall titles)
Advantage Learning Systems	Accelerated Reader
MECC/The Learning Company	Storybook Weaver, Word Munchers, Grammar Gazette
Scholastic	WiggleWorks
Edmark	Bailey's Book House
Morgan Interactive, Inc.	Best Reading Program Ever
Computer Curriculum Corporation	Integrated Learning System
Jostens Learning	Integrated Learning System
Knowledge Adventure	Jumpstart Series
Davidson	Kid Works
Creative Wonders	Sesame Street: Let's Make a Word
SkillsBank	SkillsBank /The Learning Company
Broderbund/The Learning Company	Living Books Series
Sunburst	Easy Book

Table 2: Top Reading/Language Arts Software Providers for K-12 from *The Complete K-12 Report: Market Facts & Segment Analyses 1999*, Education Market Research and Open Book Publishing, Inc.

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Vendor	Title
Davidson	Math Blaster (the top overall math title), The Cruncher, Money Town
MECC/The Learning Company	Number Munchers (one of the top overall titles), TesselMania, Geometric Golfer, Math Keys
Tom Snyder Productions	Graph Club
Scholastic	Math Shop Series
Edmark	Millie's Math House
The Learning Company	Super Solvers: Midnight Rescue!, Operation Neptune, Super Solvers: Outnumbered, Treasure Math Storm
Computer Curriculum Corporation	Integrated Learning System
Claris	Claris Works
Sunburst	Divide & Conquer, Geometric Supposer, Hot Dog Stand, Voyage of the Mimi: Ecosystems
Tenth Planet/Sunburst Communications	Geometry Investigations
Sanctuary Woods	Franklin Learns Math
Curriculum Press	Geometric Sketch Page
Jostens Learning	Integrated Learning System
Broderbund/The Learning Company	Math Workshop
Milliken	Milliken Math Sequences
Nordic Software	Turbo Math Facts
Unicorn	Fraction Action

Table 3: Top Mathematics Software Providers for K-12 from *The Complete K-12 Report: Market Facts & Segment Analyses 1999*, Education Market Research and Open Book Publishing, Inc.

Site Name	Content Area
Yahoo/Yahooligans	Reading/Language Arts (R/LA), Social Studies, Research
NASA	Research, Professional Development
Scholastic	R/LA, Math, Science, Social Studies
The Brainstation	R/LA, Science, Social Studies, Professional Development
Classroom Connect	Math, Science, R/LA, Professional Development
National Geographic	Science, Social Studies, Research
Discovery Online	Social Studies, Science, Professional Development
The White House	R/LA, Social Studies
Alta Vista	R/LA, Math, Research
PBS Online	R/LA, Science Social Studies, Professional Development
ERIC	Research, Professional Development
Kathy Schrock's Guide for Educators	Math, Research, Social Studies, Professional Development
CNN	Science, Social Studies
The Smithsonian Institution	Research, Social Studies, Research
Pitsco Inc.	R/LA, Professional Development
Weekly Reader	R/LA, Math, Science
Cochran Interactive	R/LA
The Children's Literature Web Guide	Research, R/LA
The Math Forum	Math
National Educational Service	Science, Research, Professional Development
National Science Foundation	Science
USA Today	Science, Social Studies
Science Learning Network	Science
Library of Congress	Social Studies, Research
Web Museum	R/LA, Professional Development

Table 4: Top Internet Sites for K-12, from the Top 25 Internet Sites for K-12 Instruction, Research/Reference, and Professional Development, Education Research, 1998

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